## REMARKS

Claims 1-29 are in this application. Claims 14-21 have been withdrawn as being directed to non-elected species. Claims 1-13 and 22-29 are currently pending in this application.

Applicants gratefully acknowledge that the Office Action dated April 3, 2006 has rejoined claims 22-29 to the claims of elected species A for further examination on the merits.

Claim 1 is currently amended to clarify that the self-assembled monolayer is formed from molecular species having a head functional group for interaction with said surface of said substrate and a tail group for chemical differentiation of patterned and unpatterned regions of said self-assembled monolayer "such that said patterned thin film is formed without forming a covalent bond between said self-assembled monolayer and said thin film."

Thus, claim 1, as amended, reads:

> "1. (original) A method of forming a patterned thin film, wherein said thin film is not a monolayer, said process comprising the step of:
> depositing a thin film material on a surface of a substrate having thereon a patterned underlayer of a self-assembled monolayer having patterned and unpatterned regions;
> wherein said self-assembled monolayer is formed from molecular species having a head functional group for interaction with said surface of said substrate and a tail group for chemical differentiation of patterned and unpatterned regions of said self-assembled monolayer such that said patterned thin film is formed

without forming a covalent bond between said self-assembled monolayer and said thin film."

Support for the amendment is found:

(a) on page14, line 18 to page 15, line 3, where the specification states:

"The deposition, formation, and properties of self-assembled monolayers (SAM) are active areas of scientific research. Monolayers of molecules are chosen with functional head groups that selectively bind to particular solid substrate surfaces and tail groups that pack and interact with their neighbors to form relatively ordered molecular monolayers.

Suitable molecular species that can form a self-assembled monolayer include organic molecular species having:

(1) a head functional group for interaction with the surface of the substrate forming a coated surface; and

(2) a tail group for chemical differentiation of the patterned and unpatterned regions of the coated surface."

(b) on page12, line 22 to page 13, line 3, the specification states:

"A thin film deposited by the method of the present invention is described in EXAMPLE 5. This film is not a monolayer.

The thin film in the present invention can be a material, for example, a polymer, a hybrid material, etc., which does not require a chemical reaction with the substrate surface to form a thin film. Thus, there is no covalent chemical bond formed between the thin film and the substrate. Typically, the thin film according to the present invention is physically adsorbed, not chemically bound, to the substrate (see, for example, EXAMPLE 5)."

(c) on page 24, line 29 to page 25, line 23, the specification states:

"Fig. 3A illustrates the solution deposition technique known as spin-coating. Fig. 3B depicts substrate having thereon a patterned thin film after the substrate is spun.

Following the deposition and patterning of the self-assembled molecular monolayer, a solution containing the desired thin film material 60, or a precursor, is flooded across the entire substrate surface 64, pre-patterned with a self-assembled molecular monolayer 62. The tail group of the self-assembled molecular monolayer 62 is chosen to provide chemical differentiation, for example hydrophobicity versus hydrophilicity, between patterned 62 and unpatterned 66 regions of the solid substrate surface 64. The chemical differentiation across the substrate surface, between 62 and 66, affects the wettability of the solution deposited thin film so that upon spinning, the material deposits only in unpatterned regions 66, forming a patterned thin film 68 on the substrate surface 64. The thickness of the patterned thin film material 68 is controlled by choosing the concentration of the thin film material or its precursors in the solution 60 and the rate of revolution of the spinning substrate 64."

(d) on page 31, line 27 to page 32, line 20, the specification states:

"**EXAMPLE 5**

As silicon dioxide surface on an n-type silicon wafer was patterned by microcontact printing with a self-assembled monolayer of (tridecafluoro 1,1,2,2-tetrahydrooctyl)trichlorosilane. The chemically differentiated substrate surface was used to define the pattern of a thin film of 50 nm silica particles deposited from a colloidal suspension (Highlink OG 113-53), produced by Clariant Corp,

which incorporates isopropanol and hexamethylene diacrylate as spin-casting solvents.

Silica particles and other high index particles can be used as photonic band gap materials to control the propagation and diffraction of light, and as lenses. Similarly, thin films of smaller nanocrystalline materials, which may be for example semiconducting, metallic, superconducting, ferroelectric, and magnetic, can be patterned.

These materials can be patterned for applications such as light-emitting diodes, thin film transistors, photovoltaic devices, ferroelectric memory applications and storage devices."

Claims 1-11, 22-23, and 29 are rejected under 35 USC §102(e) as being anticipated by U.S. Patent No. 6,518,168 to Clemet al., herein after "Clem et al."

The self-assembled monolayer according to the present invention is formed from molecular species having (1) a head functional group for interaction with the surface of the substrate and (2) a tail group for chemical differentiation of patterned and unpatterned regions of the self-assembled monolayer **such that said patterned thin film is formed without forming a covalent bond between said self-assembled monolayer and said thin film.**

In other words, to effect chemical differentiation of the tail group of monolayer the tail group does not require to form chemical bonds with the thin film to create pattern.

Further, a patterned thin film is obtained in a single step process wherein a patterned thin film is formed directly when the thin film material is deposited on a surface of a substrate having thereon a patterned underlayer of a self-assembled monolayer having patterned and unpatterned regions.

The reason that the patterned thin film is formed in a single step as described is that the self-assembled monolayer is formed from molecular species having a head functional group for interaction with the surface of the substrate and a tail group for chemical differentiation of patterned and unpatterned regions of the self-assembled monolayer such that the patterned thin film is formed directly, without forming a covalent bond between the self-assembled monolayer and the thin film during the step of deposition.

In contrast, the method of Clem et al. is a multi step process wherein after depositing the sol-gel precursor on the SAM, an unpatterned film is obtained. To obtain a patterened film by the method of Clem et al., "A sol-gel precursor then is applied to the surface of the substrate by, for example, dip coating or spin-casting." At this point, merely **an unpatterned film is obtained**.

Clem et al. then has to carry out several additional steps, such as:

(1) subjecting the unpatterned film to heat treatment;

(2) removing the oxide above regions 20, where the oxide is poorly adhered by thermal and/or mechanical agitation; and

(3) exposing the resulting article to conditions under which the oxide becomes crystallized.

The multi step process of Clem et al. is summarized in Col. 6, lines 14-36, which was the section cited by the Office Action:

> "FIGS. 1a-d illustrate schematically formation of a pattern of material on a substrate in accordance with the invention. In FIG. 1a an applicator 10 includes a surface 12 including indentations 14 and protrusions 15. The protrusions have

> outward-facing surfaces 16. Surface 12, at least outward-facing portions 16 thereof, is coated with a SAM-forming species 17. When the applicator is applied to substrate 18 and removed, a SAM is formed at regions 20 of the substrate contacted by outward-facing surfaces 16 (defining a stamping surface) of the protrusions, as illustrated in FIG. 1b. Intervening regions 22 of the substrate, which are not contacted by the stamping surface, are free of SAM. A sol-gel precursor then is applied to the surface of the substrate by, for example, dip coating or spin-casting. After heat treatment amorphous oxide 19 forms at regions 22 and adheres well to the substrate, but above regions 20 oxide is poorly adhered and easily removed by thermal and/or mechanical agitation, resulting in the substrate 18 including oxide 19 patterned at portions 22 of the substrate surface, that is, deposited on the substrate surface in a pattern complementary to the SAM pattern (FIG. 1d). The resulting article then can be exposed to conditions under which the oxide is crystallized."

The instant invention produces a patterned thin film from a liquid precursor in a single step without requiring additional steps of removing the thin film from the patterned area. In the process of the instant invention, the liquid precursor simply does not deposit any material in the patterned area.

In addition, the thermal and/or mechanical agitation step required by Clem et al. could damage sensitive substrates. Thus, the instant process has the clear advantage of not requiring this additional step.

Thus, the process of the instant invention is entirely different from that described by Clem et al. Therefore, claims 1-11, 22-23, and 29 are not anticipated by Clemet al. Accordingly, the rejection of claims 1-11, 22-23, and 29 under 35 USC §102(e) as being anticipated by Clem et al. should be withdrawn and claims 1-11, 22-23, and 29, and claims depending directly or indirectly therefrom, should be allowed.

Claim 12 are rejected under 35 USC §103(a) as being unpatentable over Clem et al. in view of U.S. Patent No. 5,688,642 to Chrisey et al. (herein after Chrisey et al.).

It was shown herein above that in the instant process, forming a patterned thin film is achieved in a **single step** of depositing a thin film material onto a patterned SAM and that, in sharp contrast, the process of Clem et al. required a multi step process to achieve the same. Thus, Clem et al. reference is deficient in that it does not teach or suggest the single step process of the instant invention.

Chrisey et al. describes the use of (tridecafluoro-1,1,2,2-tetrahydrooctyl) trichlorosilane to for SAM's. However, it does not teach or suggest the single step process of the instant invention. Further, the system described by Chrisey et. al. is limited to the covalent bonding of a secondary monolayer onto the original patterned monolayer, and so does not teach or suggest a process for the deposition of a thin film which is not a monolayer using solution casting techniques.

Thus, the combination of Clem et al. and Chrissey et al. still does not teach or suggest the single step process of the instant invention. Therefore, Clem et al. and Chrissey et al., either alone, or in combination, does not render claim 12 obvious. Accordingly, the rejection of claim 12 under 35 USC §103(a) should be withdrawn and claim 12 should be allowed.

Claim 13 is rejected under 35 USC §103(a) as being unpatentable over Clem et al. in view of U.S. Patent No. 5,059,258 to Wefers et al. (herein after Wefers et al.);

Claim 24 is rejected under 35 USC §103(a) as being unpatentable over Clem et al. in view of U.S. Patent No. 5,059,258 to Liang et al. (herein after Liang et al.);

Claims 25, 26, and 28 are rejected under 35 USC §103(a) as being unpatentable over Clem et al. in view of U.S. Patent No. 5,059,258 to Hawker et al. (herein after Hawker et al.); and

Claim 27, is rejected under 35 USC §103(a) as being unpatentable over Clem et al. in view of U.S. Patent No. 5,059,258 to Schildkraut et al. (herein after Schildkraut et al.).

The above rejections are grouped together and are responded to collectively because the rejected claims depend directly or indirectly from allowable claim 1 and, as such would be also allowable.

It was shown herein above that in the instant process, forming a patterned thin film is achieved in a **single step** of depositing a thin film material onto a patterned SAM and that, in sharp contrast, the process of Clem et al. required a multi step process to achieve the same. Thus, Clem et al. reference is deficient in that it does not teach or suggest the single step process of the instant invention.

Wefers et al., Liang et al., Hawker et al. or Schildkraut et al. disclose a feature in a claim which depends directly or indirectly from claim 1. However, neither Wefers et al., Liang et al., Hawker et al. nor Schildkraut et al. teaches or suggests the single step process of the instant invention.

Thus, the combination of Clem et al. with either Wefers et al., Liang et al., Hawker et al. or Schildkraut et al. still does not teach or suggest the single step process of the instant invention.

Therefore, Clem et al. in combination with Wefers et al., Liang et al., Hawker et al. or Schildkraut et al. is still deficient in that it does not teach or suggest the single step process of the instant invention and, as such, the combination does render claim 13, 24, 25, 26, 27 and 28 obvious.

Accordingly, the rejection of claims 13, 24, 25, 26, 27 and 28 under 35 USC §103(a) should be withdrawn and claims 13, 24, 25, 26, 27 and 28 should be allowed.

Applicants had provisionally elected Species A (Self-assembled monolayer is prepared by a stamp) for further prosecution. Accordingly, claims 14-21, directed to non-elected Species B (Self-assembled monolayer is prepared by exposing the self-assembled monolayer to radiation with a mask), had been withdrawn.

The Office Action dated October 19, 2005 stated that claims 1-4 are generic to Species A and Species B. Applicants agreed that claims 1-4 were generic. However, Applicants pointed out that claims 22-29 are directed to the thin film in claim 1 being deposited by a solution-based deposition process and they read on Species A and Species B. Thus, claims 22-29 should also be examined along with claims 1-4, in as much as they relate to Species A.

Applicants acknowledge that claims 22-29 have been rejoined.

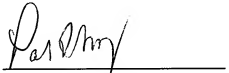
In view of the foregoing, Applicants believe that claim 1, which is generic to Species A and B, is allowable. Accordingly, Applicants respectfully point out that if an independent claim is unobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

Further, in accordance with linking claim practice, if the claims of a non-elected species (Species B, directed to self-assembled monolayer being prepared by exposing the self-assembled monolayer to radiation with a mask) is free of prior art, the non-elected species must also be rejoined and allowed.

Therefore, Applicants respectfully request reconsideration of this application, rejoining of withdrawn claims 14-21 and allowance of all currently pending claims.

Accordingly, an early indication of the allowability of claims 1-29 by issuance of a Notice of Allowability is earnestly solicited.

Respectfully submitted,

Date: February 6, 2007 By: 

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